

ASSIGNMENT 3

Textbook Assignment: "Force and Pressure," chapter 9, pages 9-1 through 9-7; "Hydrostatic and Hydraulic Machines," chapter 10, pages 10-1 through 10-10; and "Machine Elements and Basic Mechanisms," chapter 11, pages 11-1 through 11-15.

- 3-1. With which of the following devices is force measured?
1. A manometer
 2. A bourdon gauge
 3. A spring scale
 4. A barometer
- 3-2. Pressure is expressed in terms of
1. distance and density
 2. volume and force
 3. density and volume
 4. area and force
- 3-3. If a cylindrical tank which stands on end is 4 feet in diameter and contains 350 pounds of water, the pressure on the bottom of the tank is approximately
1. 22 lb per sq ft
 2. 28 lb per sq ft
 3. 65 lb per sq ft
 4. 350 lb per sq ft
- 3-4. At sea level, what is the force of the atmosphere on each side of a cube measuring 16 inches on a side?
1. 380 lb
 2. 890 lb
 3. 2,400 lb
 4. 3,840 lb
- 3-5. If the pressure in a steam boiler that supplies pressure to a piston 4 inches in diameter is 600 pounds per square inch, the total force exerted on the piston is approximately
1. 150 lb
 2. 600 lb
 3. 2,400 lb
 4. 7,500 lb
- 3-6. The airbrake cylinder on a railroad car has a diameter of 8 inches. The locomotive supplies compressed air to this cylinder at 90 pounds pressure per square inch. How much force is transmitted to the brake shoes when the brakes are applied?
1. 720 lb
 2. 4,520 lb
 3. 5,000 lb
 4. 6,500 lb
- 3-7. When the pressure being measured with the gauge shown in textbook figure 9-4 is decreased, the linkage end of the Bourdon tube has a tendency to move so as to cause the
1. tube to become less curved
 2. tube to become more curved
 3. pointer to turn clockwise
 4. pointer and gear to turn in opposite directions
- 3-8. In which of the following situations would a Schrader gauge be used instead of a Bourdon gauge or diaphragm gauge?
1. Measuring the force that air exerts on an object at sea level
 2. Measuring pressure in a hydraulic system in which the load fluctuates rapidly
 3. Measuring the force that water exerts on an object at the bottom of a tank
 4. Measuring air pressure in the space between inner and outer boiler casings

- 3-9. What instrument is best for measuring pressure differences in an atmosphere of air where the pressure ranges between 31 and 32 inches of mercury?
1. Bourdon gauge
 2. Schrader gauge
 3. Manometer
 4. Diaphragm gauge
- 3-10. A barometer is used to measure
1. absolute temperature
 2. atmospheric pressure
 3. relative humidity
 4. steam pressure
- 3-11. The forces in an aneroid barometer that balance each other are the
1. resistance of a metal box to stretching or compression plus the tension in a spring and atmospheric pressure
 2. resistance of a metal box to stretching or compression plus the force exerted by the air in the box, and the force exerted by the atmosphere
 3. force exerted by steam under pressure and the tension in a spring
 4. force resulting from expansion in a metal bar and the tension in a spring
- 3-12. The forces in a mercurial barometer which balance each other are the
1. weight of a column of mercury plus the force exerted by the air in the tube above the mercury, and the force exerted by the atmosphere plus 14.7 psi
 2. force exerted by steam under pressure and the force exerted by the weight of a column of mercury
 3. forces exerted by the atmosphere and the weight of a column of mercury
 4. weight of a column of mercury, and the pressure of the vacuum above the mercury plus the force exerted by the atmosphere
- 3-13. If an airtight container is filled with steam and then cooled so that the steam condenses, the pressure inside the container is reduced because
1. a volume of steam weighs less than an equal volume of water
 2. the pressure on the surface of a liquid is always zero
 3. the water resulting from the condensation of the steam cannot be compressed
 4. a partial vacuum results from the condensation of the steam
- 3-14. Which of the following instruments is used for measuring pressures in the condenser for a steam turbine?
1. Barometer
 2. Schrader gauge
 3. Manometer
 4. Bourdon tube gauge
- Information for items 3-15 and 3-16: Pressure measurements are generally classified as absolute pressure or gauge pressure. Absolute pressure is the total pressure, including that of the atmosphere; it is the pressure measured above zero pressure as a reference level. Gauge pressure is the difference between absolute pressure and the pressure of the atmosphere; it is pressure measured above atmospheric pressure as a reference level.
- 3-15. At sea level, the pressure in a tire is 24 psi gauge pressure. The absolute pressure in the tire is approximately
1. 39 psi
 2. 33 psi
 3. 24 psi
 4. 9 psi
- 3-16. At sea level, the pressure in an air tank as measured by an aneroid barometer is 31 inches of mercury. How much greater or less than atmospheric pressure is the pressure in the air tank?
1. 1 inch more
 2. 1 inch less
 3. 2 inches less
 4. 2 inches more

3-17. A manometer is an example of forces in equilibrium. The forces that balance each other are the

1. force exerted by the atmosphere and the force exerted by the liquid inside the closed container
2. force exerted by the gas inside the closed container plus the weight of the liquid on one side of the tube, and the force exerted by the atmosphere plus the weight of the liquid in the other side of the tube
3. force exerted by the steam in the steam line and the weight of a column of liquid
4. force exerted by the gas inside the closed container and the weight of part of the liquid in the tube

3-18. What instruments are interchangeable as pressure-measuring devices?

1. Aneroid barometer and mercurial barometer
2. Schrader gauge and manometer
3. Spring scale and steel yard
4. Bourdon gauge and diaphragm-type pressure gauge

3-19. Hydrostatic pressure is the pressure exerted by

1. gas in motion
2. gas at rest
3. liquid at rest
4. liquid in motion

3-20. Density is defined in terms of

1. pressure and volume
2. weight and distance
3. pressure and area
4. weight and volume

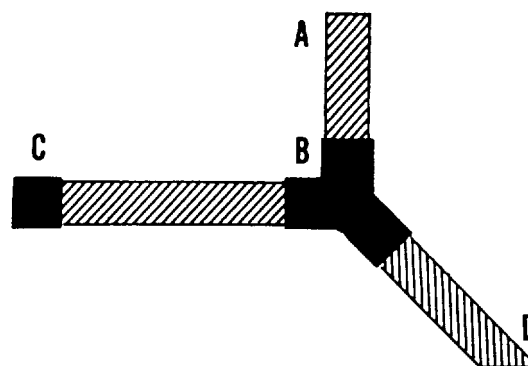


Figure 3A

3-21. The pipes in figure 3A are filled with water. Pipe AB is vertical; pipe CB is horizontal; pipe ED points downward at an angle. The point of greatest pressure is at point

1. A
2. B
3. C
4. D

3-22. The density of lead is approximately how many times greater than the density of water?

1. 5
2. 7
3. 9
4. 11

3-23. Which of the following is a true statement concerning the pressure of water on a submerged submarine?

1. The pressure is equal on the top and on the bottom
2. The pressure is greater on the top than on the bottom
3. The pressure is greater on the bottom than on the top
4. There is pressure only on the top

- 3-24. If one cubic foot of substance A weighs more than one cubic foot of substance B, what is the relationship between the densities of substances A and B?
1. The density of substance A is greater than the density of substance B
 2. The density of substance A is less than the density of substance B
 3. The density of substance A is the same as the density of substance B
 4. Not enough information is given to determine the relationship
- 3-25. Depth charges are dropped in the vicinity of a submerged submarine. The depth charge illustrated in textbook figure 10-1 is set so as to be exploded by the
1. speed of the depth charge as it nears the submarine
 2. speed of the depth charge as it enters the water
 3. impact of the depth charge against the hull of the submarine
 4. pressure of the water at the estimated depth of the submarine
- 3-26. Hydrostatic pressure in a torpedo is employed to
1. maintain the torpedo on course
 2. launch the torpedo
 3. keep the torpedo at desired depth
 4. increase the torpedo speed
- 3-27. In a torpedo depth engine, the setting of the depth screw determines the
1. pressure of the air supplied to the depth engine
 2. length of the pendulum
 3. angular set of the vertical rudders
 4. amount of force which is required to move the diaphragm
- 3-28. The air pumped into a diver's suit helps him or her to withstand the pressure of the water because
1. pressure of the air in the diver's suit is greater than the pressure of the water
 2. air enters the diver's body so that the pressure inside his or her body is equal to the water pressure
 3. air is compressible and water is not
 4. force is not transmitted by air
- 3-29. The pressure in a diver's suit must be released gradually because
1. if pressure is released too rapidly, the air which entered the diver's body under high pressure will cause bubbles to form in his or her blood stream
 2. the diver's lungs cannot quickly become adjusted to breathing air at normal pressure
 3. the diver's blood circulation was partly cut off while under high pressure, and sudden return of normal circulation is painful
 4. air at normal pressure contains less oxygen than air at high pressure, and the body must adjust to this condition gradually
- 3-30. The pitometer log determines the speed of a ship by measuring the difference between
1. hydrostatic pressure near the keel of the ship and hydrostatic pressure near the water line
 2. hydrostatic pressure and the pressure of water in motion past the ship at the same depth
 3. pressure of the water moving past the ship and atmospheric pressure
 4. pressure of the water moving past the ship and the speed of surface wind

3-31. The speed of a ship can be determined from a pitometer log by

1. multiplying the reading on the pitometer log by a constant factor which is dependent upon the characteristics of the ship
2. combining the reading of the pitometer log with the reading of the engine revolution counter
3. dividing the reading by the density of the water
4. reading it directly from the calibrated scale

3-32. A hydraulic machine is one which operates as a result of forces transmitted by

1. mechanical energy
2. electrical energy
3. steam in a closed space
4. liquid in a closed space

3-33. A closed hydraulic system will not operate properly if air is present in the lines or cylinders because

1. air is highly compressible and cannot be used to transmit forces
2. air, being compressible, would not transmit the applied pressure
3. air interferes with the proper operation of the valves
4. air increases the pressure in both cylinders

3-34. Which of the following is NOT a true statement concerning transmission of pressure in a liquid in a closed space?

1. Pressure applied to any part of the liquid is transmitted equally to all points in the liquid
2. Pressure applied to any part of the liquid is transmitted to all points in the liquid without loss
3. Pressure in the liquid causes it to expand and increase in density
4. Pressure in the liquid acts at right angles to the walls of the container regardless of the shape of the container

3-35. Which of the following has NO relationship to the mechanical advantage of a hydraulic machine with one small and one large piston?

1. The area of the small piston
2. The area of the large piston
3. The length of the connecting tube
4. The distances the two pistons move

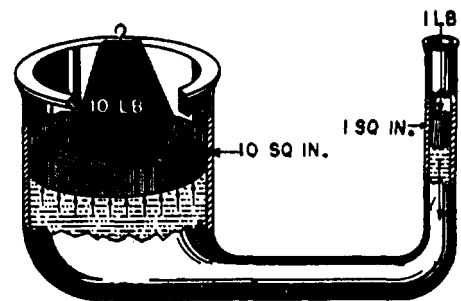


Figure 3B

Items 3-36 through 3-38 are related to figure 3B.

3-36. If the weight on the large piston just balances the weight on the small piston, it follows that the

1. force per unit of area is the same on both pistons
2. weights on the two pistons are equal
3. force on the large piston equals that on the small piston
4. pressure is greater below the small piston than it is below the large piston

3-37. If a certain force is applied to the small piston, what are the relationships between pressures in various parts of the system?

1. The pressure on the small piston is greater than the pressure on the large piston
2. The pressure on the small cylinder is the same as the pressure acting against the small piston and is greater than the pressure in the large cylinder
3. The pressure in the connecting tube is the same as the pressure in the small cylinder and is greater than the pressure in the large cylinder
4. The pressure is the same on all parts of all surfaces that enclose the liquid

3-38. Let F_1 be the force applied to the small piston and F_2 be the force exerted by the large piston. Which equation represents the relationship between the forces F_1 and F_2 ?

1. $F_2 - F_1 = 10$
2. $10 F_1 = F_2$
3. $F_1 + F_2 = 10$
4. $F_1 = 10 F_2$

3-39. The area of the small piston in a hydraulic press is 3 square inches and the area of the large piston is 75 square inches. If a force of 50 pounds is applied to the small piston, the large piston will (neglecting frictional losses) exert a force of

1. 25 lb
2. 250 lb
3. 725 lb
4. 1,250 lb

3-40. In a hydraulic press, how does the distance the small piston moves compare with the distance the large piston moves?

1. The small piston will always move a greater distance than the large piston
2. The large piston will always move a greater distance than the small piston
3. Both pistons will move the same distance
4. There is no relationship between the movements of the two pistons

Items 3-41 and 3-42 are related to the hydraulic press shown in textbook figure 10-10.

3-41. What is the main function of the check valves?

1. To prevent the liquid from escaping from the large cylinder into the reservoir
2. To prevent the liquid in the reservoir from flooding the small cylinder
3. To make possible several short strokes, instead of one long stroke, with the small piston
4. To allow the large piston to return to its starting position

3-42. What is the principle function of the globe valve?

1. To protect the cylinder from excessive pressure
2. To prevent the liquid in the reservoir from flooding the small cylinder
3. To make possible several short strokes instead of one long stroke with the piston
4. To allow the fluid in the large cylinder to flow back into the reservoir

3-43. A main ballast tank on a submarine is filled with sea water by

1. allowing air to escape from the vents at the top of the tank and allowing water to enter through flood ports at the bottom of the tank
2. pumping air from the tank and pumping water into the tank through the vents at the top
3. pumping it in through the vents at the top of the tank
4. pumping it in through the ports at the bottom of the tank

3-44. How is the water removed from the main ballast tanks when a submerged submarine is surfacing?

1. Motor-driven pumps syphon off the water
2. The water is forced out with high-pressure air
3. The water flows out through ports under the pull of gravity
4. Hydraulic pumps syphon off the water

3-45. The variable ballast tanks on a submarine are filled with sea water by

1. allowing air to escape from the tanks and water to enter through flood ports at the bottom of the tanks
2. pumping air from the tanks and allowing the water to enter through vents at the top of the tanks
3. either of the above methods
4. pumping it in

3-46. Hydraulic machines are used aboard submarines for

1. opening and closing the vent valves of the main ballast tanks
2. raising and lowering the periscope
3. opening and closing the vent valves of the safety tanks
4. all of the above purposes

When answering items 3-47 and 3-48, refer to figure 10-14 of your textbook.

3-47. The purpose of an accumulator in the hydraulic system is to

1. accumulate oil as it is released from the reservoir
2. keep the air in the system at a constant pressure
3. accumulate excess oil which flows past check valves in the system
4. keep the oil in the system under pressure

3-48. To what part, if any, is the piston in the accumulator fastened?

1. A rod which is operated by a crankshaft
2. A rod which is activated by pressurized oil in the reservoir
3. A main flood valve
4. None

3-49. Why is it easier to push a 50-pound barrel up a gangplank than to push a 50 pound box?

1. Rolling friction is less than a sliding friction
2. The shape of a barrel defies gravity better than the shape of a box
3. The barrel has a greater surface to come in contact with the gangplank
4. All of the above reasons

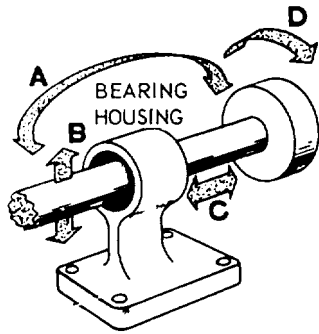


Figure 3C

Items 3-50 through 3-52 are based on figure 3C.

- 3-50. Which of the following types of bearing is often used in the housing to provide free movement in the direction indicated by arrow C?

1. Thrust bearing
2. Journal bearing
3. Reciprocal motion bearing
4. Tapered roller bearing

- 3-51. A radial ball bearing used in the housing is superior to a journal bearing for

1. reduction of friction under heavy twisting stress as indicated by arrow A
2. absorption of stress as indicated by arrow B
3. prevention of shaft motion as indicated by arrow C
4. reduction of friction during high-speed rotation of the shaft as indicated by arrow D

- 3-52. What type of bearing is designed to permit free rotation of the shaft while restraining motion in the direction indicated by arrow C?

1. Radial ball bearing
2. Needle roller bearing
3. Thrust bearing
4. Journal bearing

- 3-53. The two hardened steel rings of a ball bearing assembly are called the

1. rollers
2. races
3. separators
4. shoulders

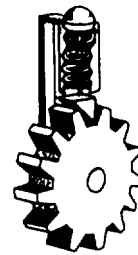


Figure 3D

- 3-54. The spring in the mechanism shown in figure 3D is used to

1. store energy for part of a functioning cycle
2. force a component to engage another component
3. return a component to neutral position after displacement
4. counterbalance a weight or thrust

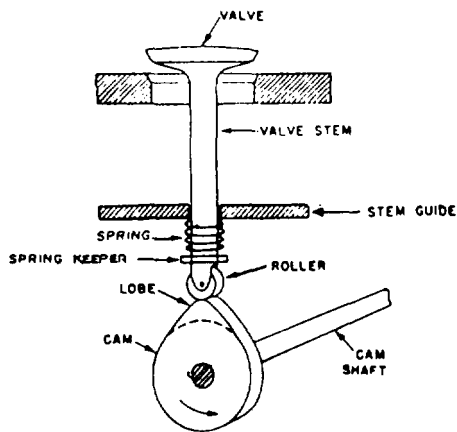


Figure 3E

3-55. The function of the spring in figure 3E is to

1. store energy for part of a cycle
2. counterbalance a weight or a thrust
3. return a component to its original position after displacement
4. permit some freedom of movement between aligned components without disengaging them

3-56. Which of the following types of springs can be used in compression, extension, or torsion?

1. Flat spring
2. Spiral spring
3. Helical spring
4. Each of the above

3-57. What are volute springs?

1. Spiral springs made of plaited strands of cable
2. Helical, conical springs wound with each coil partly overlapping the coil next to it
3. Flat springs made of slightly curved plates
4. Double cone springs with their large ends joined together

3-58. As used in some automotive suspension systems, straight torsion bars reduce shock or impact by

1. compressing
2. twisting
3. bending
4. telescoping

3-59. What gear of the gear differential is fastened to the spider shaft?

1. Input gear
2. End gear
3. Output gear
4. Spider gear

3-60. In the gear differential shown in figure 11-11 of your textbook, in proportion to the sum of revolutions of the end gears, how many revolutions does the spider make?

1. One half as many
2. The same number
3. Twice as many
4. Four times as many

3-61. Which of the following statements is true of a gear differential no matter which type of hook-up is used?

1. The spider will follow the end gears for half the sum or difference of their revolutions
2. The two side gears are the inputs and the gear on the spider shaft is the output
3. The spider shaft is one input, and one of the sides is the other output
4. If the two inputs are equal and opposite, the spider-shaft will move in either direction

3-62. Slightly worn linkages can probably be adjusted by lengthening or shortening the rods and shafts.

1. True
2. False

- 3-63. Rocker arms are a variation of which of the following parts?
1. The clevis
 2. The lever
 3. The turn buckle
 4. The coupling
- 3-64. The counterbalance weights on the clamps of a sleeve coupling serve to
1. increase speed
 2. decrease shaft vibration
 3. transmit motion from a link moving in one direction to a link moving in a different direction
 4. change rotary motion to linear motion
- 3-65. The coil spring in an Oldham coupling serves to
1. reduce friction between the coupling disks
 2. keep the coupling disks in place
 3. make allowance for changes in shaft length
 4. strengthen the coupling
- 3-66. What device is used to couple two shafts that meet at a 15° angle?
1. Sleeve coupling
 2. Hooke joint
 3. Oldham coupling
 4. Flexible coupling
- 3-67. The amount of whip in shafts coupled by a Hooke joint depends on the
1. strength of the joint
 2. number of degrees the shafts are out of line
 3. difference in the lengths of the shafts
 4. combined weight of the shafts and the joint
- 3-68. The fixed, flexible, and Oldham couplings have a common use, which is to connect rotating shafts that are
1. perfectly aligned
 2. misaligned by more than 25°
 3. slightly misaligned
 4. severely stressed
- 3-69. What advantage does a vernier-type coupling have over a sliding lug coupling?
1. Simplicity of operation
 2. Strength
 3. Flexibility
 4. Accuracy of adjustment
- 3-70. Cams are generally used for all of the following purposes EXCEPT
1. transmitting power
 2. changing the direction of motion from up and down to rotary
 3. controlling mechanical units
 4. synchronizing two or more engaging units
- 3-71. When the valve of figure 3E is not being lifted by the cam lobe, the cam roller is held in contact with the edge of the cam by the
1. speed of the camshaft
 2. spring as it shortens
 3. weight of the valve
 4. spring as it lengthens
- 3-72. A function of the clutch in the drive mechanism of a power boat is to
1. permit changes in gear ratio
 2. disconnect the engine from the propeller shaft
 3. reverse the pitch of the propeller
 4. reverse the direction of the engine rotation

3-73. What type of clutch has interlocking teeth?

1. Single disk
2. Cone
3. Hele-Shaw
4. Spiral claw

3-74. Either a positive clutch or a friction clutch may be used in a gear train to

1. obtain a greater mechanical advantage
2. synchronize gear speeds before the gears are meshed
3. permit interruption of power transmission through the train
4. compensate for slight angular misalignment of shafts

3-75. Magnetic and induction clutches differ mainly in the manner in which the

1. movable clutch face is actuated
2. contacting surfaces are lubricated
3. driving and driven faces are brought into contact
4. power is transmitted between the driving and driven members